Highlights

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Washington SCIENCE TRENDS

SPACE CONFLICTS

Official sources indicate that the Administration is facing another "agonizing reappraisal" as the time comes to draw up plans for the Fiscal 1961 budget. Project costs in military and civilian space developments are causing increased concern. Expenditures, particularly for advanced rocket vehicle development, are soaring well beyond original expectations.

Pentagon is putting two-thirds of its space funds into reconnaissance satellite development. Army, Navy and Air Force complain that this work, though necessary, short-changes other vital space programs for defense. Military officials fear that they will be asked to share the staggering costs of tracking, communications and recovery for the civilian "Project Mercury" manned satellite program.

Officials of the Civilian Space Agency, NASA, complain that they are not receiving the cooperation they would like from the Pentagon. They point to the recent public statement by Roy Johnson, Director of the Advanced Research Project Agency of the Pentagon, to the effect that he had drawn up a six-year program for future space projects but hadn't gotten around to informing NASA of his intentions. Pentagon officials, on the other hand, maintain, that NASA ventures are cutting into their funds to a dangerous level.

ULTIMATE WEAPON?

The following statement, reprinted here without comment, is from an official Air Force publication, distributed this week:

"Through the toy industry, it is possible to reach almost every citizen in the United States. A child is seldom permitted to purchase a toy by himself--his parents usually do the buying. Thus, we have adults as well as youngsters associated with the toy, the toy business, and the item which the toy represents.

"It seems that the toy is an excellent vehicle that can be used to stimulate the interest, curiosity and imagination of the American youngster --and his parents, in the national defense activities and in the objectives and needs of aerospace power of this country. It is felt that this is a medium of communication which has unlimited possibilities..."

RADIOISOTOPE APPLICATIONS: Atomic Energy Commission, Georgia Institute of Technology and Lockheed Aircraft will sponsor a two-day symposium on industrial uses of radioisotopes in Atlanta, Ga. May 11-12. Details from the Director, Short Courses and Conferences, Georgia Institute of Technology, Atlanta 13, Ga. Management, technical personnel and educators are invited.

The Solion -- A New Electronic Technology

Naval Ordnance Laboratory predicts "large scale application" in many fields for the Solion, an electrochemical device it has developed in collaboration with private industry. The device is a short designation for "ions in solution" in contrast to the migration of electrons in space, as in vacuum tubes, or across a solid, as in transistors.

* Low Frequency Applications -- NOL reports that the Solion is highly sensitive to low-energy stimuli and requires very little power; from 100 to 1000 times less than that for transistors. It is believed possible that it may prove more efficient than transistors at low frequencies, particularly in remote and unattended devices.

Limited frequency response will be a drawback in some applications but is viewed as an advantage in any system whose basic frequency is a small fraction of a cycle per second. Vacuum tube and transistor amplifiers, as an example, usually will not operate at these frequencies without the addition of such electronic complications as chopping modulation or direct coupling.

* Typical Device -- NOL describes the basic type of solion as a device in the form of a plastic cylinder with flexible corrugated diaphragms serving as end-walls, and containing a solution of potassium iodide and iodine. In this solution, several platinum or other noble metal electrodes are immersed. The unit is divided in its center by a thin plastic wall pierced by a small orifice around which is located the cathode. Unit is designed to convert mechanical pressure into an electrical output. Small, low-voltage (nine-tenths volt) batteries in series with a resistive load are employed.

* Stimulation Requirements -- Stimulation required to bring about necessary hydraulic flow within the Solion may be by means of pressure, motion, sound, heat or light.

* Production Factors -- Solion units produced for NOL are of pocket watch size and negligible weight. External size is not critical although the internal size and placement of the electrodes may be an important factor. With further research it is believed the unit will be readily adaptable to mass production. This should lead to low cost. Other advantages are small size and weight, extreme sensitivity, low power consumption, simplicity and ease of maintenance.

* Applications -- NOL believes that when the Solion is designed for specific uses "there is indeed a promising range of potential commercial applications." Among those now envisioned are:

Rate Circuits of all descriptions, whether operated from temperature, pressure, or electrical sources.

Integration Units, such as those requiring continuous read-out of high precision; of sufficient accuracy for acceleration guidance systems. Small visual exposure meters for personnel protection around jet engines, similar to film and other devices used for radiation, are also possible.

Detection and Measurement, of acoustic signals of low frequency, acceleration and other phenomena.

NOL also predicts Solion application in product circuits involving either electrical derivatives or hydraulic flow, or both; in electrical and small signal hydraulic amplifiers; in computer circuits and in amplifiers.

(Report available. 44 pages. $1.25. Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 131 931)

PLASMA JET RESEARCH

National Bureau of Standards has developed a modified Plasma Jet and is investigating its possibilities as a high-energy source for spectrographic analysis of complex alloys. Work is sponsored by the Navy Bureau of Aeronautics.

* Plasma Jet Concept -- In essence, the plasma jet is created by heating a gas stream to extremely high temperatures through the constriction of an electric arc passing between two electrodes. The hot ionized gas comprising the arc plasma emerges through an opening in the cathode as a flame-like jet. Such jets are currently being applied for high temperature studies in physics and chemistry in several laboratories, and as a source of high-temperature, high-velocity gas streams for wind tunnels.

Plasma jets for such applications have been operated at currents from 50 to many hundreds of amperes, the Bureau points out. As a result, jets several inches long and temperatures as high as 50,000°C have been produced. However, neither extremely high temperatures nor a very long flame are said to be necessary for application as a spectroscopic source.

* Alloy Analysis -- For spectrochemical analysis of alloys, the Bureau staff designed a plasma jet to be operated on conventional direct-current power of 15 to 20 amperes. This permits the jet to reach as high as 8000° C. In use, a solution of the test specimen is drawn up a capillary tube and sprayed into the arc plasma. The plasma jet vaporizes the solution and excites the elements to emit spectra not ordinarily obtained at lower temperatures with conventional flame processes.

* Test Results -- In preliminary tests, iron, chromium and nickel, the major constituents of stainless steel, were determined with a two percent coefficient of variation. Further studies are in progress, the Bureau says, to observe the characteristics of the modified plasma jet, and to improve its accuracy and sensitivity as a spectroscopic source.

(Report available. Free. Write Office of Technical Information, National Bureau of Standards, Washington 25, D.C. for Summary Technical Report No. 2289)

NATIONAL RESEARCH INSTITUTES

National Science Foundation is asking Congress for some $500,000 to support site, engineering and staffing studies for a National Institute of Atmospheric Research. However, the Foundation has not yet committed itself to support of the proposed Institute, a joint venture by a number of universities. Approval of such a project would open the way toward creation of many other basic research establishments.

National Science Board has outlined its own policy toward such Institutes. In general, the Board believes that national needs for large undertakings in applied research and development should be met, wherever feasible, through existing resources and organizations. However, the need for completely new institutions for specialized basic research is recognized, particularly in fields of "magnitude or urgency" beyond the capacity of a single university or organization. And there must be "ample evidence" that existing facilities are inadequate or inappropriate.

GROUND EFFECT VEHICLES

Army, Navy and Air Force are currently sponsoring intensive research and development on so-called ground effect vehicles which generally achieve "lift" from a cushion of high-pressure air "sealed" between the base of the vehicle and the ground. With proper modification such craft appear capable of efficient operation over land, sea or in the air.

ARMY-AIR FORCE APPLICATIONS

* Avrocar -- Major U.S. program in the ground effect field is sponsorship of the Avrocar, a "flying saucer" configuration vehicle being developed under a $4.1 million contract with AVRO Aircraft Ltd. of Canada. This research vehicle is still classified. It will have a hovering capability as do other ground effect machines but will be capable of soaring 10,000 feet or more. Development is near completion, construction is well underway and a prototype is expected to undergo ground tests in the near future. Army officials believe the Avrocar appears to offer a great potential for increasing mobility in combat. Extreme noise is one major problem.

* FASS Vehicle -- Army has a feasibility study contract with National Research Associates, Inc., College Park, Md. for vehicles employing a Free Air Suspension System. Models demonstrated to Congress during the past week employed peripheral jet sheets to develop lifting pressure under a vehicle. Machines are believed capable of traveling several feet off the ground at high speeds. Development points to mobility over rugged terrain, water, mud, quicksand, desert sand, arctic tundra, ice or snow. Low ground pressure, some 20-40 pounds per square foot, indicates ability to cross mine fields with safety.

NAVAL APPLICATIONS

U.S. Navy is sponsoring ground effect research and development through Bureau of Aeronautics, Bureau of Ships and Office of Naval Research.

Possible applications, as viewed by Rear Admiral Rawson Bennett, Chief of Naval Research:

* Amphibious Transport or Assault Boat -- For such missions a boat-type bow and water-tight structure with a low silhouette and moderate load-lifting capability are indicated. Such craft would travel 4 or 5 feet over wave tops at speeds up to 50 miles per hour, and would be capable of negotiating beaches up to a 15 percent slope. It is believed that they would present a far less vulnerable target than present-day craft and would open the world's tideland and river delta areas as avenues of approach for assault or for peaceful cargo moving. One "medium-size" skimmer concept is 320 feet long, 120 feet wide and employs some 84,000 horsepower with a load carrying capacity of millions of pounds.

* Hunter-Killer Platform -- This radio-controlled platform would in concept, have the appearance of a large laboratory flask. It would have to operate at heights only great enough to clear the waves and at speeds only 20 percent higher than the latest atomic submarine. The platform, as envisioned, would be capable of floating in heavy seas for extended times. It would then lift and track automatically. The platform would be designed to place a bomb or charge directly on the enemy submarine by radio command from the mother ship, and then scoot away to safety.

* Ocean-Going Transport -- Navy is negotiating a $2,500 contract with Carl Weiland, a Swiss designer, to purchase certain theoretical and experimental model tests results in connection with circular ship platforms. Designs combine annular jet principle with air-bearing or labyrinth seal. A number of concentric sheets of air prevent total air leakage around the flange. Such machines might operate up to 50 feet above the waves with high maximum weight lifting potential and stability.

Navy Sponsored Research -- Here is an official summary of Navy research and development programs planned or underway:

* Wind Tunnel Tests -- A $100,000 contract with Aerodynamics Laboratory of the David Taylor Model Basin, to continue theoretical studies and to build and test models in wind tunnels is under consideration.

* Test-Bed -- First test flight is expected this August under a $50,000 contract with the Gyrodyne Co. to construct and test the static and dynamic characteristics of a man-carrying test hovering machine.

* Ocean-Going Vehicle -- Bureau of Aeronautics has recently negotiated a $50,000 contract with Convair division of General Dynamics to study the design feasibility of a very large flying vehicle for over-ocean operation, employing aircraft type structures and possibly including a nuclear power source.

* Catamaran-Type Ship -- Bureau of Ships has started a $30,000 contract with the David Taylor Model Basin Hydrodynamics Laboratory to construct and test models of catamaran ship-type vehicles in a towing tank.

* Curved Jet Research -- A $30,000 contract with Aerophysics Co.calls for theoretical analyses of the flow processes in the curved jet in both hovering and forward flight, and to continue correlations and evaluations of available experimental results.

* Wave Conditions -- Office of Naval Research has a $21,000 contract with the University of California to test small models over water at varying forward speeds and different simulated wave conditions.

* Geometric Parameters -- Small model wind tunnel and water table tests are now in progress under a $30,000 contract with the State University of Iowa for study of the influence on performance of changes in various geometric parameters.

* Information Exchange -- Navy is arranging with ONERA, the French National Aeronautical Research Laboratory, a cooperative exchange of unclassified research information in the ground effects field.

FUTURE RESEARCH

All military programs in this field are now being "coordinated"by the Department of Defense. A technical review and analysis of known ground effect programs will take place early in May at the Forrestal Research Center, Princeton University. An international technical symposium, covering work being accomplished in the Western World, is contemplated for later this year.

SCIENTIFIC IMPOSSIBLES?

An unusual list of "things science tells us we cannot do" was presented in Washington during the past week by Howard A. Wilcox, Deputy Director, Defense Research and Engineering, Department of Defense. The "impossibles" are presented here in slightly condensed form. Any challenges?

* "We do not think an anti-gravity screen, fabled in science fiction, is possible of development. This conclusion is based on a very wide variety of experiments and is sanctified in Einstein's theory of gravitation....

* "We do not think energy can be created except by the vanishing of proportionate quantities of mass in accordance with Einstein's famous formula $E = MC^2$. Energy and mass taken together in proper ratio represent a fixed and constant total in our locality of the galaxy.....

* "We do not think it possible to get useful work from any large fraction of the vast quantity of heat energy in the oceans. This is a conclusion from the second law of thermodynamics....

* "We do not believe that the simultaneous measurement of the position and velocity of a particle of matter can be reduced in uncertainty below a definite known numerical value...Unfortunately, this irreducible amount of uncertainty is so small in magnitude that it promises us no practical limitation of the aiming accuracy of an ICBM.

* "We believe that one can compress only a definite maximum amount of information into a given time-bandwidth product for a given communication channel....

* "We do not think it possible to perform an experiment which measures the absolute speed of the earth, say relative to any postulated absolute space.

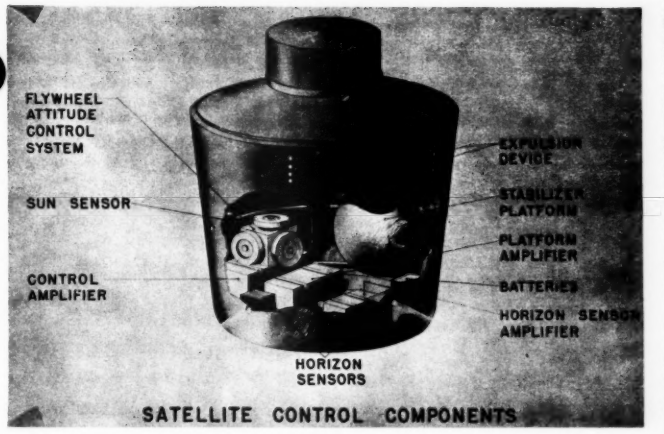
* "We do not believe it possible to design a H.G. Wells type time-traveling machine....

* "We do not believe it will ever be possible for any actual material body to remain structurally solid if its average temperature rises above a few thousand degrees F."

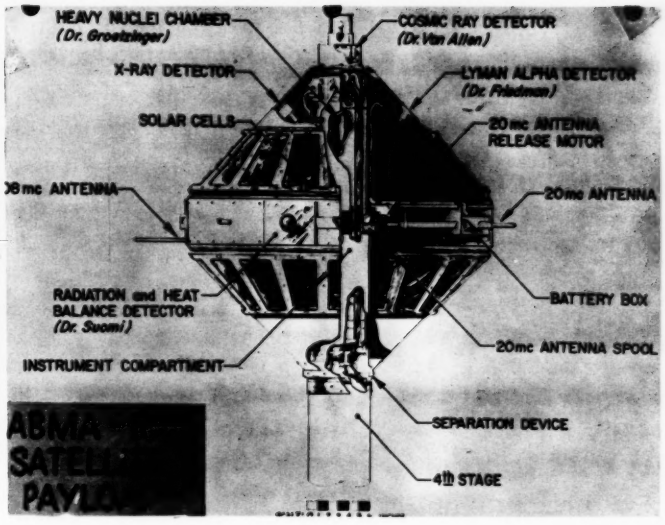
From his experience as a weapon scientist, Dr. Wilcox also concludes that it is impossible to provide a 100 percent effective military defense of any large target -- such as the USA or USSR against "all the various ways it can be attacked with lethal modern weapons."

ADVANCED SPACE CONCEPTS (FACING PAGE)

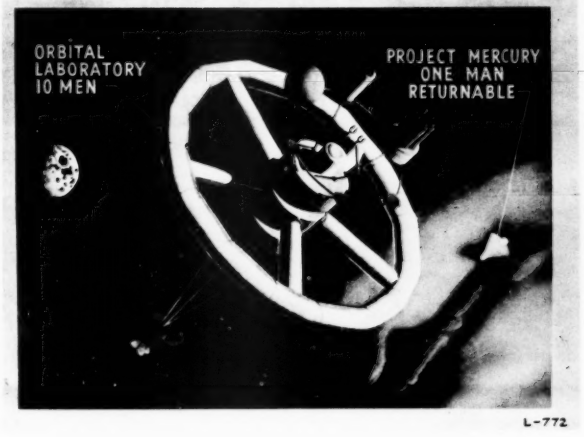
Sketches of some advanced space concepts of the National Aeronautics and Space Administration are reproduced on the facing page. The ABMA-IGY satellite payload pictured is planned for launching with a JUNO II vehicle later this year. Unmanned erectible satellite is being studied in connection with communication relay experiments. Orbital Laboratory, ion rocket and space ship structures are in the nature of concepts or proposals at the present time.



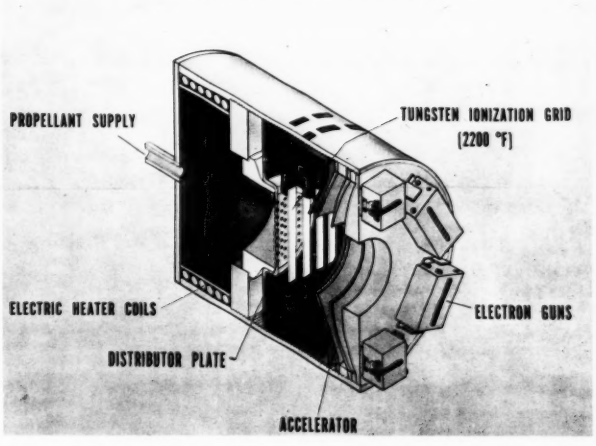
SATELLITE CONTROL COMPONENTS



MANNED SATELLITES



MODEL OF ION ROCKET



NASA L-59-1037

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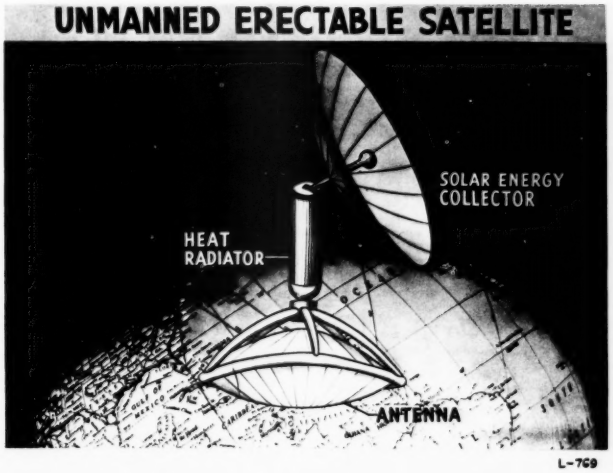
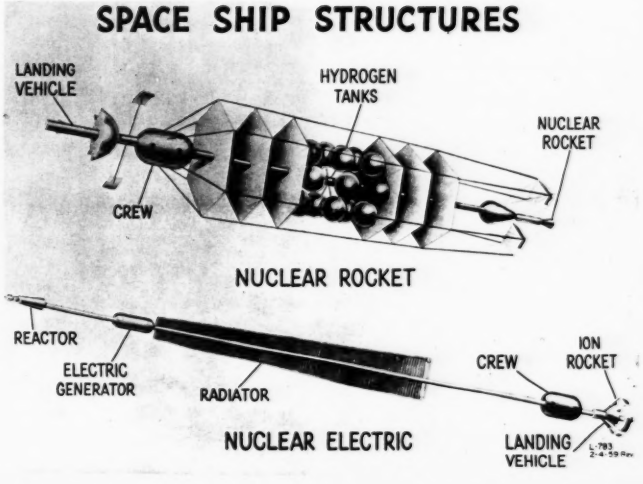


SPACE SHIP STRUCTURES



PUBLICATIONS CHECKLIST

( ) Atomic Energy, a two-volume set of the papers presented at the Inter-American Symposium on peaceful applications of atomic energy. First volume deals with plans and programs, training and education, management and physical sciences and technology. Second volume covers life sciences in general, medicine, biology and agriculture. 621 pages. $6. (Write OTS,U.S. Department of Commerce,Washington 25, D.C. for TID 7554)

( ) Research and Development, and its impact upon the American economy. A brief but comprehensive survey by Dr. Alan T. Waterman, Director, National Science Foundation, including comments on the need for more basic research by industry. 4 pages. Free. (Write National Science Foundation, Washington 25, D.C. Att: Information Office, for R&D Review NSF 59-17)

( ) Radio Transmitters, a Defense Department manual just reprinted designed to give the reader a fundamental background in the theory of operation of the various basic transmitter circuits. Explains theory and operation of oscillators and modulation systems and discusses operation and use of test and auxiliary equipment. 173 pages. $2. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Publication D 301.7:100-6)

( ) Energy Spectrum, a study of the energy spectrum resulting from the slowing down of electrons in various materials; that is, the energy distribution of the electrons that traverse any small volume of material when they are produced with a given energy by sources distributed through the material. 16 pages. 20 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for Publication C 13.4: 597)

( ) Academic Research, a comprehensive study of expenditures and manpower for scientific research and development in colleges and universities. Covers the years 1953-4 but just published. The first full survey of its kind. 173 pages. Single copies free. (Write National Science Foundation, Washington 25, D.C., Attn: Information Office, for Publication NSF-59-10)

( ) Patent Policies, a report on policies and programs relating to patents and a discussion of the reproduction rights to scientific articles. 28 pages. Free. (Write Committee on Judiciary, Subcommittee on Patents, Senate Office Building, Washington 25, D.C. for Report No. 97)

( ) Uranium-Phosphate Geochemistry, a scientific report on the results of extensive field and laboratory studies of the occurence of uranium in phosphates, showing how distribution has been controlled by geologic processes. Also discusses possible aluminum and phosphate utilization in certain Florida deposits. 60 cents. (Write Superintendent of Documents, Government Printing Office, Washington 25, D.C. for U.S. Geological Survey Professional Paper 314-D)

( ) Oxygen, a literature survey of 691 references dealing with the electrical generation of oxygen and related fields. Compiled to aid further work toward providing breathing oxygen for long-term, extra-atmospheric flight 111 pages. $2.50. (Write OTS, U.S. Department of Commerce, Washington 25, D.C. for PB 151 260)